

WHAT IS CLAIMED IS:

1. A reader for reading a shape of a surface of an object comprising:  
a magnetic displacement portion; and  
5 a detecting portion,  
wherein when the magnetic displacement portion comes into contact  
with the surface of the object, a magnetic state of the magnetic displacement  
portion differs depending on the shape of the surface, and  
the detecting portion detects the magnetic state of the magnetic  
10 displacement portion.
2. The reader according to claim 1, wherein the shape of the surface  
includes a convex portion and a concave portion, and  
the magnetic state of the magnetic displacement portion differs  
15 between a region facing the convex portion and a region facing the concave  
portion due to a pressure generated by contact of the surface with the  
magnetic displacement portion.
3. The reader according to claim 2, wherein the magnetic displacement  
20 portion comprises a transition material for converting mechanical energy  
into magnetic energy.
4. The reader according to claim 3, wherein the transition material  
comprises a magnetostrictive material.  
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5. The reader according to claim 3, wherein the transition material  
comprises a material with a composition expressed by Fe-Z, where Z is at  
least one element selected from the group consisting of Mn, Co, Ni, Cu, Al,  
Si, Ga, Pd, Pt, Tb, and Dy.  
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6. The reader according to claim 3, wherein an amount of change in  
deformation of the transition material is not less than  $10^{-3}\%$ .
7. The reader according to claim 3, wherein the magnetic displacement  
35 portion further comprises a soft magnetic layer,  
the soft magnetic layer and the transition material are coupled  
magnetically, and

a magnetic state of the soft magnetic layer differs depending on a magnetic state of the transition material.

8. The reader according to claim 1, wherein the detecting portion  
5 comprises a coil and detects the magnetic state by using the coil.

9. The reader according to claim 1, wherein the detecting portion  
comprises a magnetoresistive element and detects the magnetic state by  
using the magnetoresistive element.  
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10. The reader according to claim 9, wherein the magnetoresistive  
element comprises a multilayer structure that comprises a non-magnetic  
layer and a pair of magnetic layers sandwiching the non-magnetic layer,  
a resistance value differs depending on a relative angle between  
15 magnetization directions of the magnetic layers,  
the magnetic displacement portion comprises a transition material  
for converting mechanical energy into magnetic energy, and  
the magnetization direction of one of the magnetic layers differs  
depending on a magnetic state of the transition material.  
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11. The reader according to claim 10, wherein one of the magnetic layers  
and the transition material are coupled magnetically.

12. The reader according to claim 10, wherein the magnetoresistive  
25 element further comprises an antiferromagnetic layer, and  
the antiferromagnetic layer is arranged so that the other magnetic  
layer is sandwiched between the antiferromagnetic layer and the  
non-magnetic layer.

13. The reader according to claim 10, wherein at least one magnetic  
30 layer selected from the pair of magnetic layers comprises a non-magnetic  
film and a pair of magnetic films sandwiching the non-magnetic film.

14. The reader according to claim 13, wherein magnetic coupling  
35 selected from laminated ferrimagnetic coupling and magnetostatic coupling  
is established between the pair of magnetic films.

15. The reader according to claim 1, wherein the magnetic displacement portion is fixed in a direction perpendicular to the surface of the object.
- 5 16. The reader according to claim 1, wherein the magnetic displacement portion is movable in a direction perpendicular to the surface of the object.
17. The reader according to claim 1, wherein the magnetic displacement portion is arranged in at least one form selected from a point, a line, and a plane.
- 10 18. The reader according to claim 1, wherein the detecting portion is arranged in at least one form selected from a point, a line, and a plane.
- 15 19. The reader according to claim 1, further comprising a first scanning portion for moving the magnetic displacement portion,  
wherein the first scanning portion moves the magnetic displacement portion along the surface of the object so that the shape of the surface is read.
- 20 20. The reader according to claim 1, further comprising a second scanning portion for moving the detecting portion,  
wherein the second scanning portion moves the detecting portion along the magnetic displacement portion so that the magnetic state of the magnetic displacement portion is detected.
- 25 21. The reader according to claim 1, wherein the object is a human body.
22. The reader according to claim 21, wherein the shape of the surface is a fingerprint.
- 30 23. An authentication device comprising:  
a reader;  
a memory; and  
a matching portion,
- 35 wherein the reader reads a shape of a surface of an object and comprises a magnetic displacement portion and a detecting portion, wherein when the magnetic displacement portion comes into contact with the surface

of the object, a magnetic state of the magnetic displacement portion differs depending on the shape of the surface, and the detecting portion detects the magnetic state of the magnetic displacement portion,

- 5           the memory stores a shape of a surface of an object beforehand, and  
          the matching portion matches the shape read by the magnetic displacement portion with the shape stored in the memory.